Fig. 1

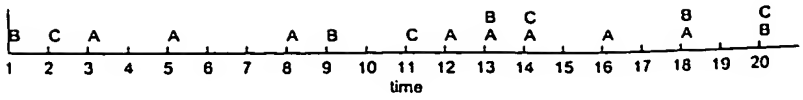



Fig. 2

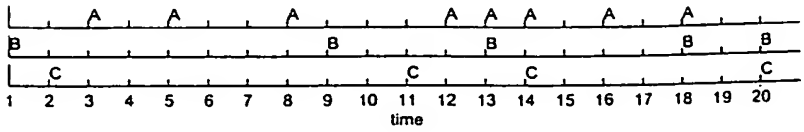



Fig. 3A

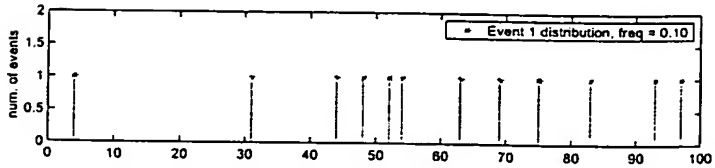



Fig. 3B

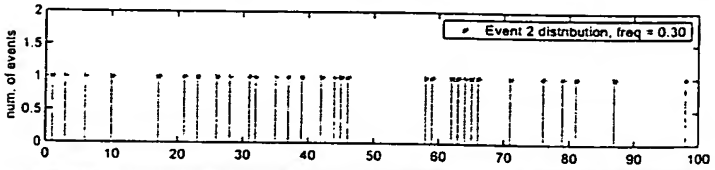



Fig. 3C

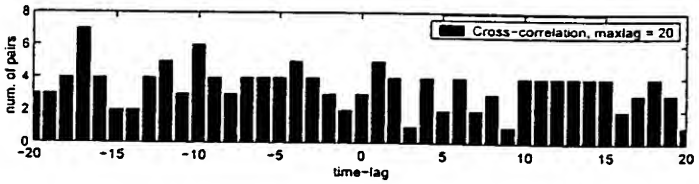



Fig. 4A

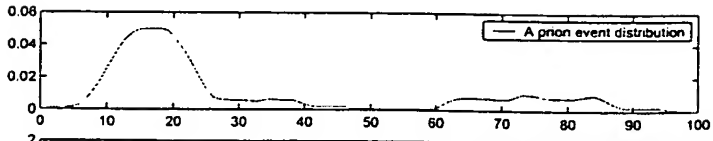



Fig. 4B

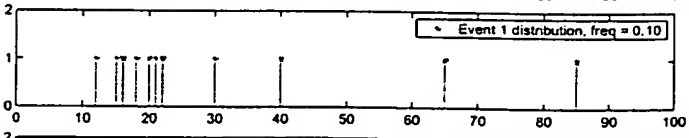



Fig. 4C

Fig. 4D

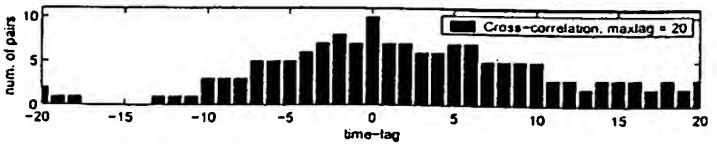
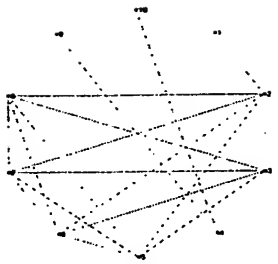
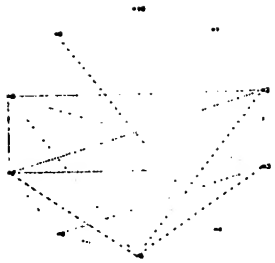


Fig 5A



(a)



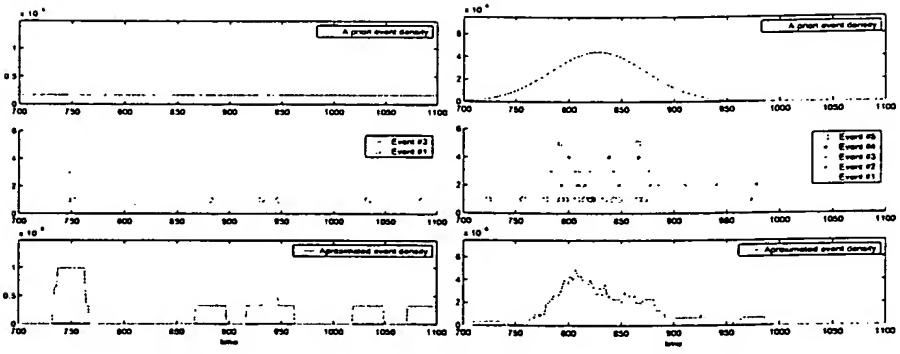
(b)

Fig. 5B

Fig. 6A1

Fig. 6A2

Fig. 6A3



(a) (b)

Fig. 6B1

Fig. 6B2

Fig. 6B3

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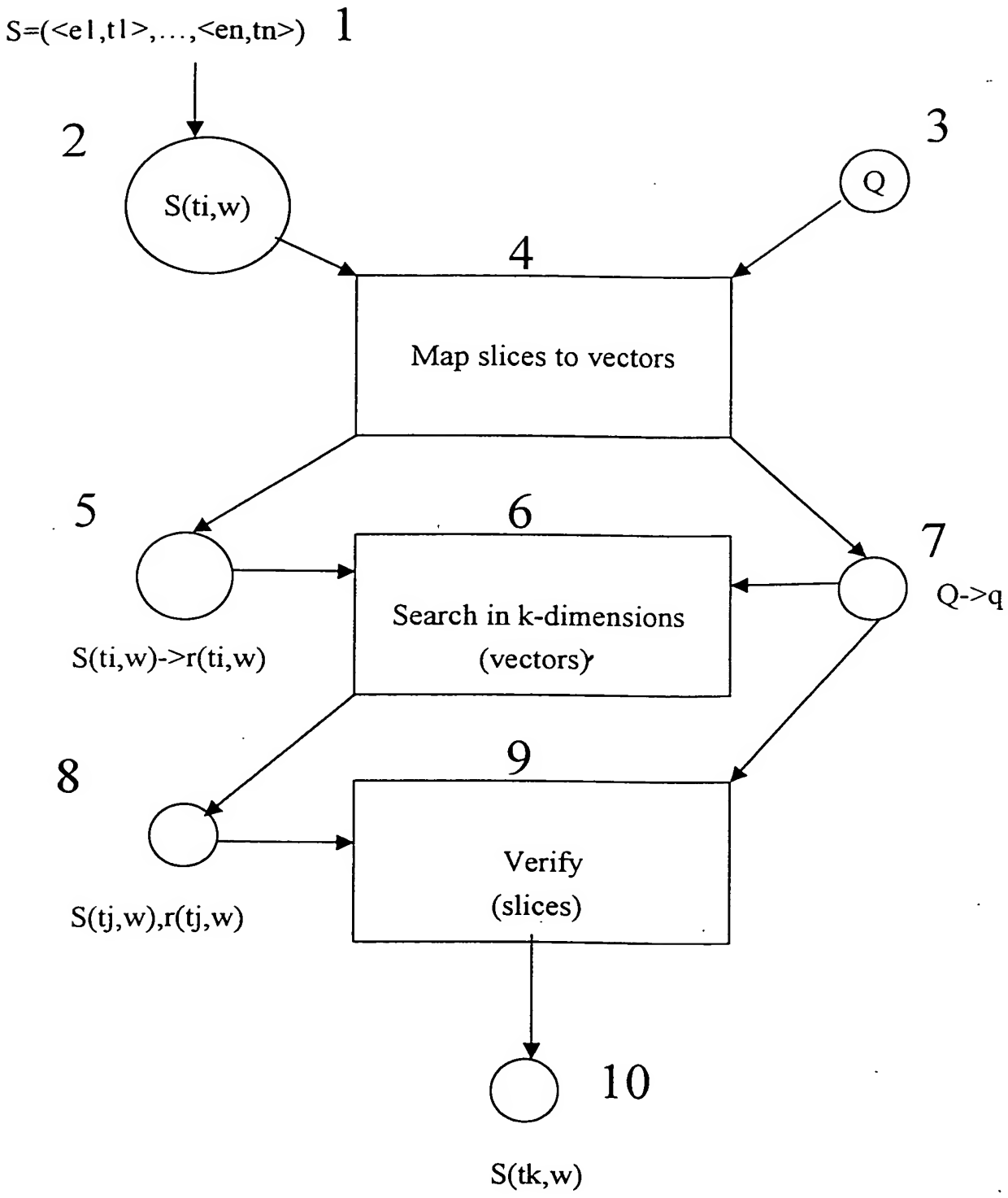



Figure 7.

Figure 8

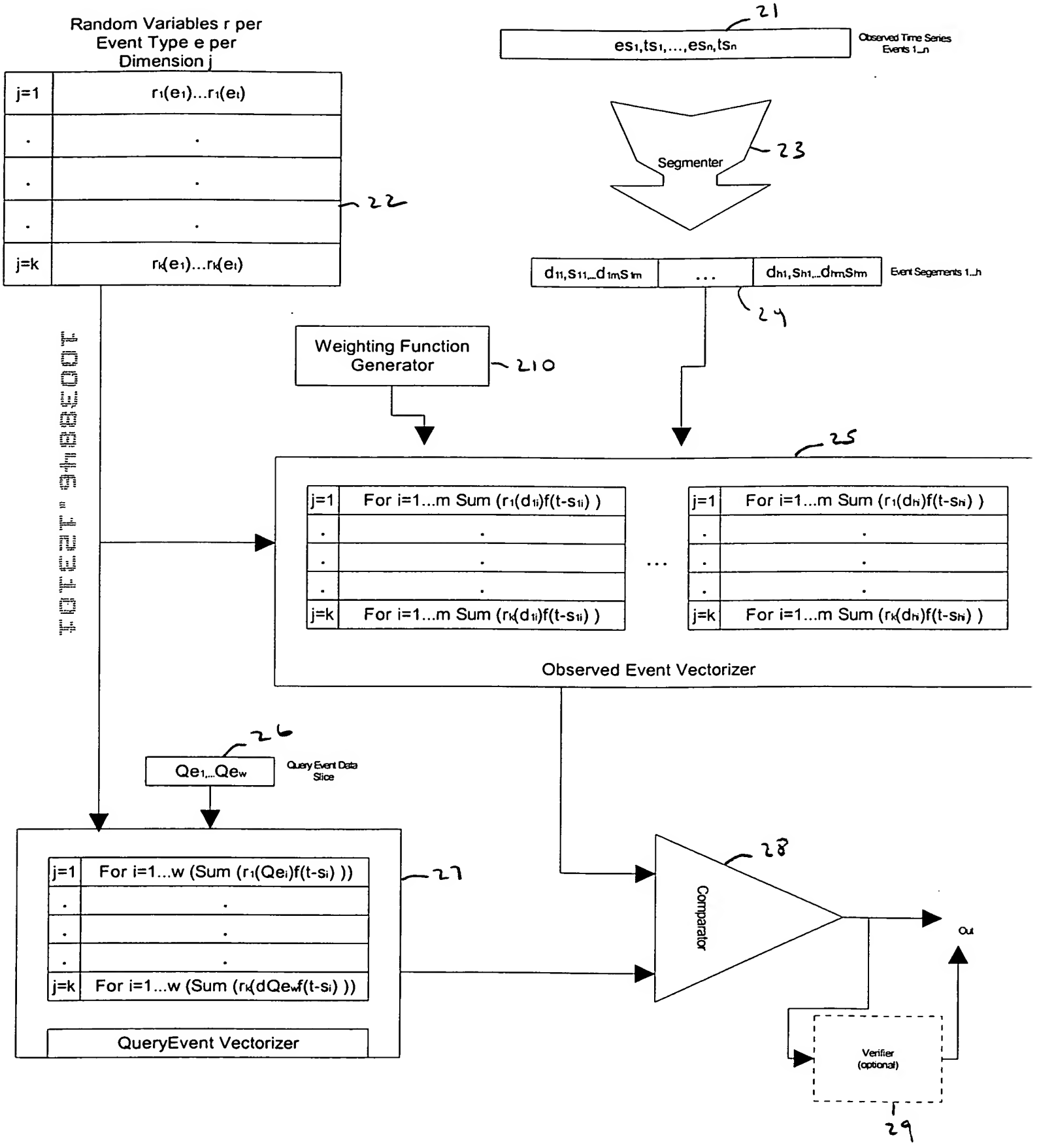

Random Variables r per Event Type e per Dimension j
j=1
r1(e1)...r1(el)
j=k
rk(e1)...rk(el)
22
21
es1,ts1,...,esn,tsn
Observed Time Series Events 1..n
Segmenter
23
d11,s11...d1mS1m
...
dh1,sh1,...dhmShm
Event Segements 1..h
24
Weighting Function Generator
210
Feedback Path
25
For i=1...m Sum (r1(d1i)f(t-s1i) )
For i=1...m Sum (rk(d1i)f(t-s1i) )
For i=1...m Sum (r1(dhi)f(t-shi) )
For i=1...m Sum (rk(dhi)f(t-shi) )
Observed Event Vectorizer
26
Qe1,...Qew
Query Event Data Slice
For i=1...w (Sum (r1(Qei)f(t-si) ))
For i=1...w (Sum (rk(dQewf(t-si) ))
27
QueryEvent Vectorizer
28
Comparator
Out
Verifier (optional)
29

Fig. 9

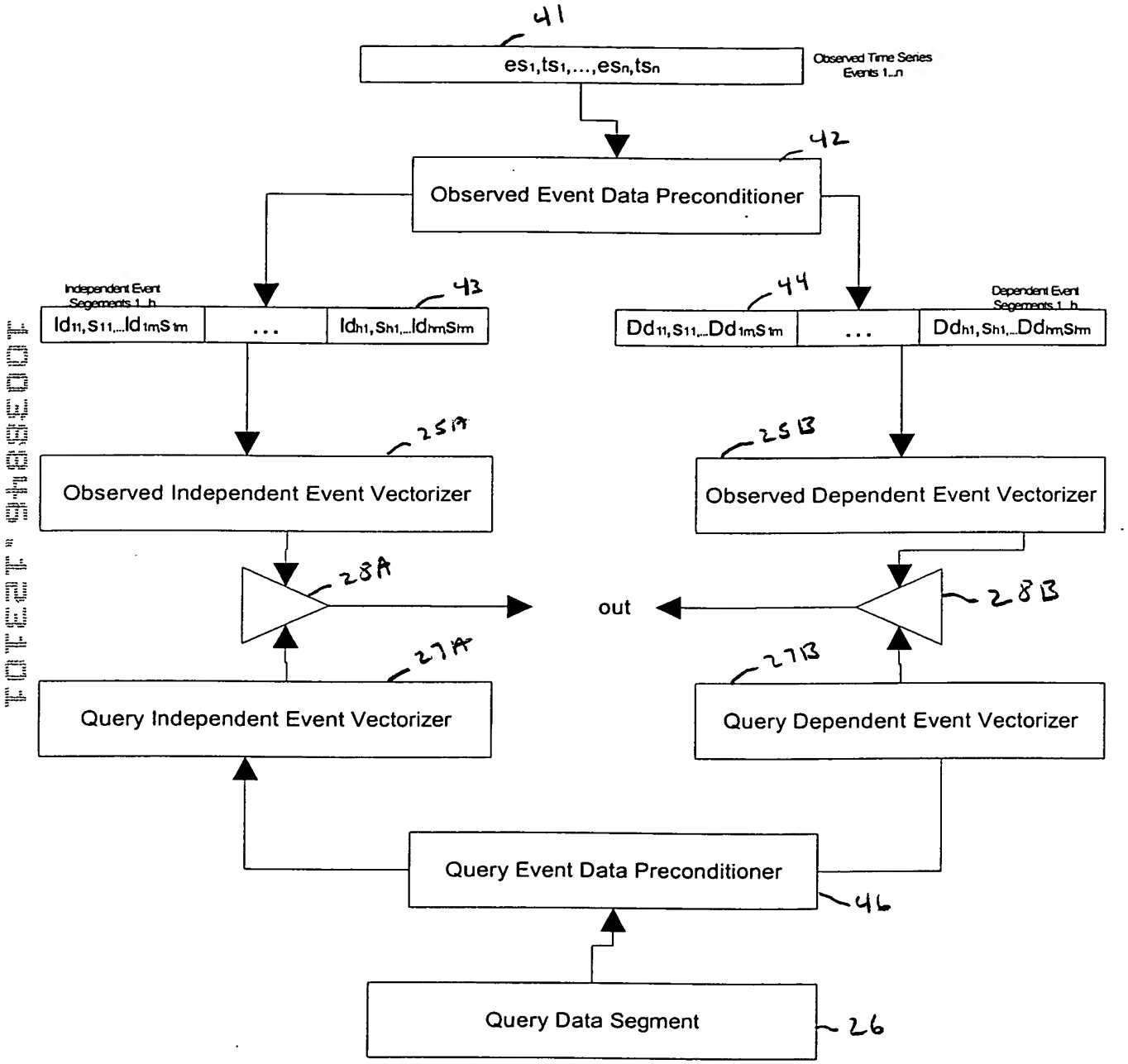

41
es1,ts1,...,esn,tsn
Observed Time Series Events 1..n
42
Observed Event Data Preconditioner
Independent Event Segements 1..h
43
Id11,s11,...Id1mS1m
...
Idh1,sh1,...IdhmShm
44
Dependent Event Segements 1..h
Dd11,s11,...Dd1mS1m
...
Ddh1,sh1,...DdhmShm
25A
Observed Independent Event Vectorizer
25B
Observed Dependent Event Vectorizer
28A
out
28B
27A
Query Independent Event Vectorizer
27B
Query Dependent Event Vectorizer
Query Event Data Preconditioner
46
Query Data Segment
26

Fig. 9A

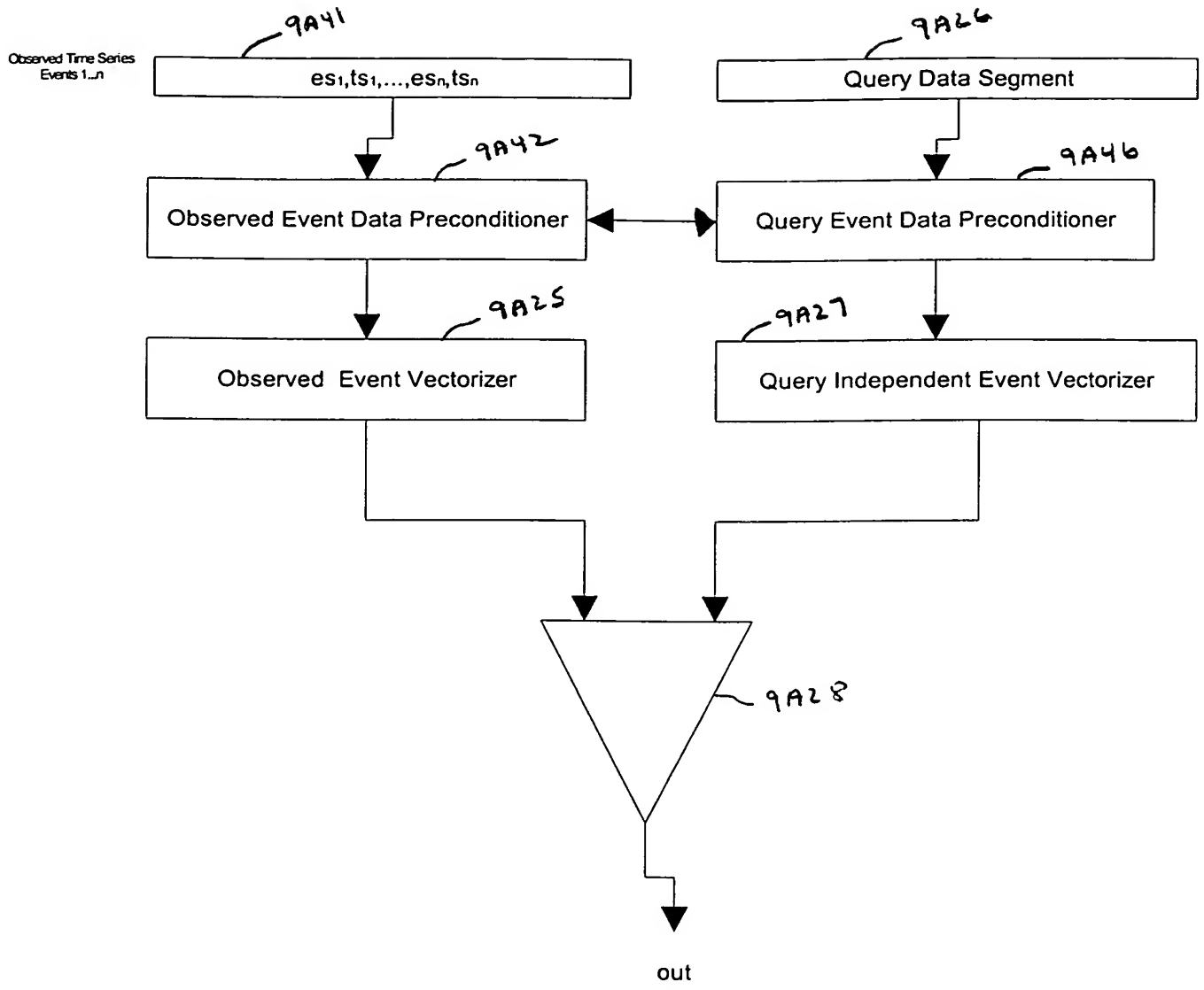
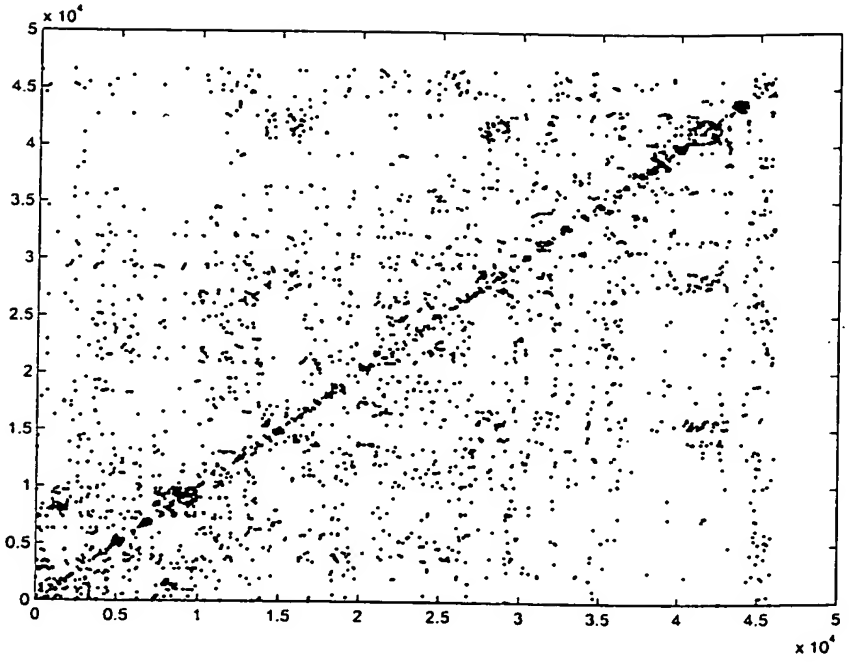

9A41
Observed Time Series Events 1..n
es1,ts1,...,esn,tsn
9A26
Query Data Segment
9A42
Observed Event Data Preconditioner
9A46
Query Event Data Preconditioner
9A25
Observed Event Vectorizer
9A27
Query Independent Event Vectorizer
9A28
out

Fig. 10




The location of the closest slice to the query slice, for every 10th event in the sequence and for W=1000 sec.

Fig. 11

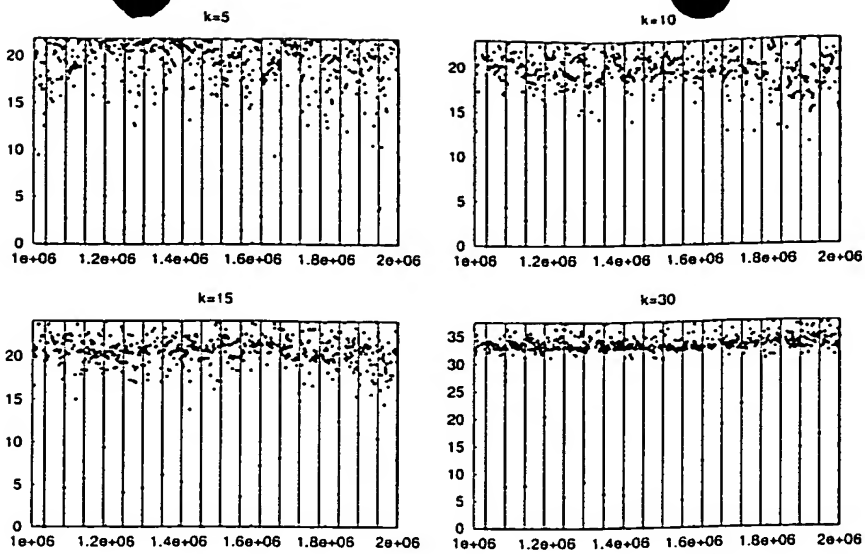
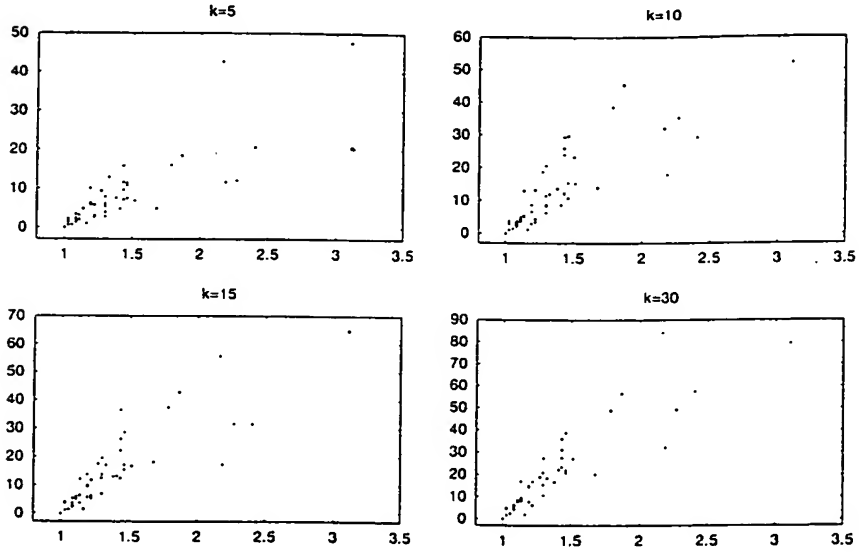



Fig. 12




*Distances of target windows against the density ratio, alarm data*

Fig. 13

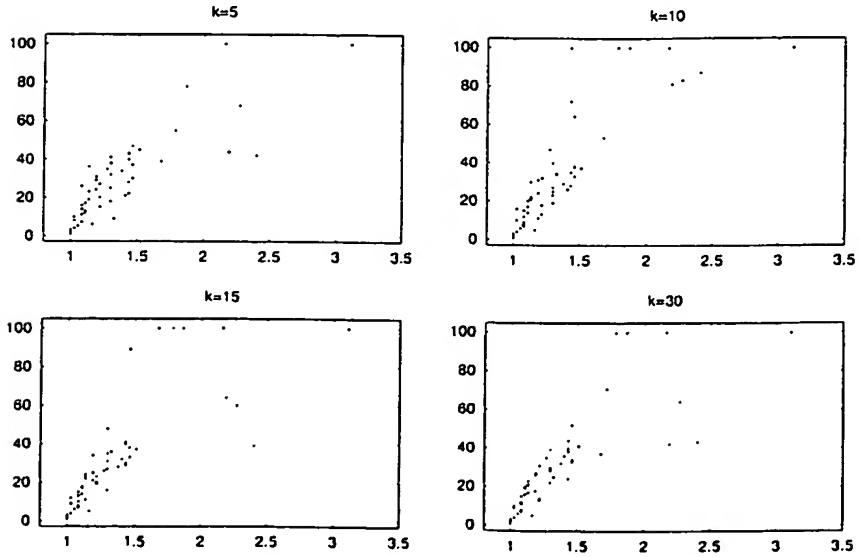


Fig. 14

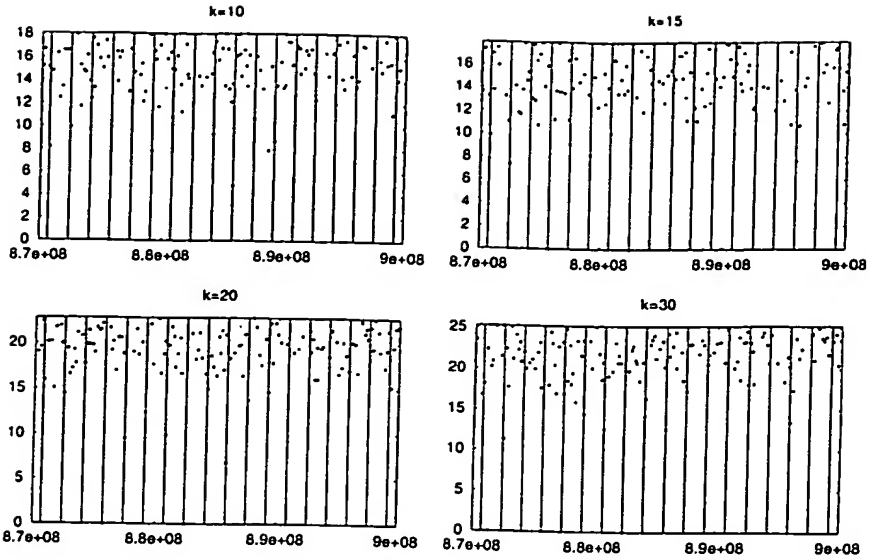



Fig. 17

| Dist | Window | Closest | Offset |
|---|---|---|---|
| 0.00 | 1461230 | 1461230 | exact |
| 0.00 | 2157420 | 2157420 | exact |
| 0.00 | 1032800 | 1032800 | exact |
| 1.02 | 2210970 | 2210970 | exact |
| 1.26 | 497272 | 497272 | exact |
| 1.32 | 711484 | 711484 | exact |
| 2.10 | 872143 | 872143 | exact |
| 2.59 | 3067820 | 3067820 | exact |
| 3.55 | 1568330 | 1568330 | exact |
| 3.61 | 2425180 | 2425180 | exact |
| 3.68 | 604378 | 604378 | exact |
| 4.00 | 657931 | 657931 | exact |
| 4.04 | 1247010 | 1247010 | exact |
| 4.55 | 1300570 | 1300570 | exact |
| 4.57 | 925696 | 925696 | exact |
| 4.57 | 3121370 | 3121370 | exact |
| 4.58 | 1086360 | 1086360 | exact |
| 4.79 | 2532290 | 2532290 | exact |
| 5.27 | 1407670 | 1407670 | exact |
| 5.64 | 2371432 | 2371630 | -198 |
| 5.70 | 1139910 | 1139910 | exact |
| 5.82 | 2585840 | 2585840 | exact |
| 6.13 | 1354120 | 1354120 | exact |
| 7.17 | 1621733 | 1621880 | -147 |
| 7.95 | 1996493 | 1996760 | -267 |

| Dist | Window | Closest | Offset |
|---|---|---|---|
| 8.11 | 1675060 | 1675440 | -380 |
| 8.41 | 3014113 | 3014260 | -147 |
| 8.57 | 2799882 | 2800050 | -168 |
| 8.58 | 979102 | 979249 | -147 |
| 9.32 | 1193557 | 1193460 | 97 |
| 10.18 | 818800 | 818590 | 210 |
| 10.26 | 2639124 | 2639390 | -266 |
| 10.42 | 1942820 | 1943200 | -380 |
| 10.49 | 2853333 | 2853600 | -267 |
| 11.02 | 2478783 | 2478730 | 53 |
| 11.02 | 1889383 | 1889650 | -267 |
| 11.33 | 2103614 | 2103860 | -246 |
| 12.17 | 2692793 | 2692940 | -147 |
| 12.41 | 1835763 | 1836100 | -337 |
| 12.91 | 2906893 | 2907160 | -267 |
| 13.14 | 2264140 | 2264520 | -380 |
| 13.75 | 3059438 | | missed |
| 13.77 | 1428734 | | missed |
| 14.08 | 2959387 | | missed |
| 14.17 | 755127 | | missed |
| 14.43 | 1961635 | | missed |
| 14.59 | 2053796 | | missed |
| 14.88 | 1729345 | 1728990 | 355 |
| 15.01 | 1116290 | | missed |
| 15.26 | 2087183 | | missed |

Dist=Distance to query window
Window=Position (time) of window found
Closest=Position of closest target window, if closer than 1000
Offset=Difference of this window and closest target

*Distances of fifty closest selected windows, $k = 15$, alarm data*

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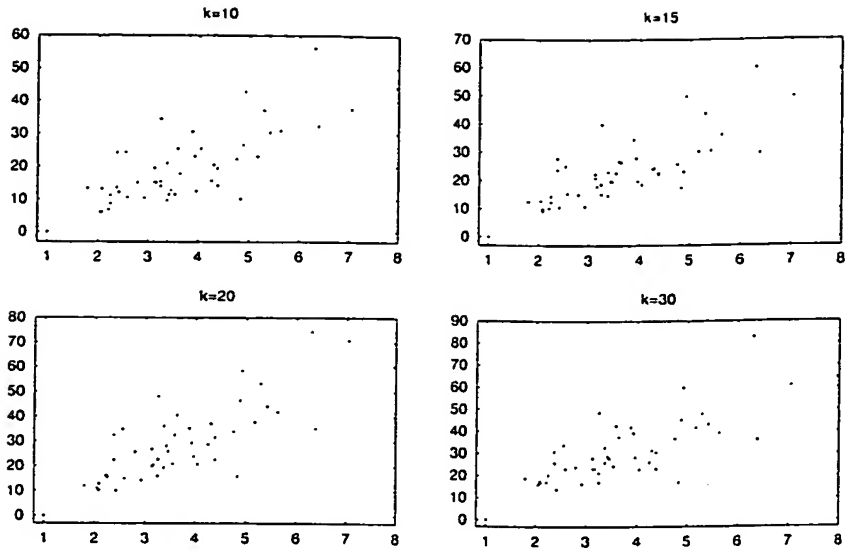
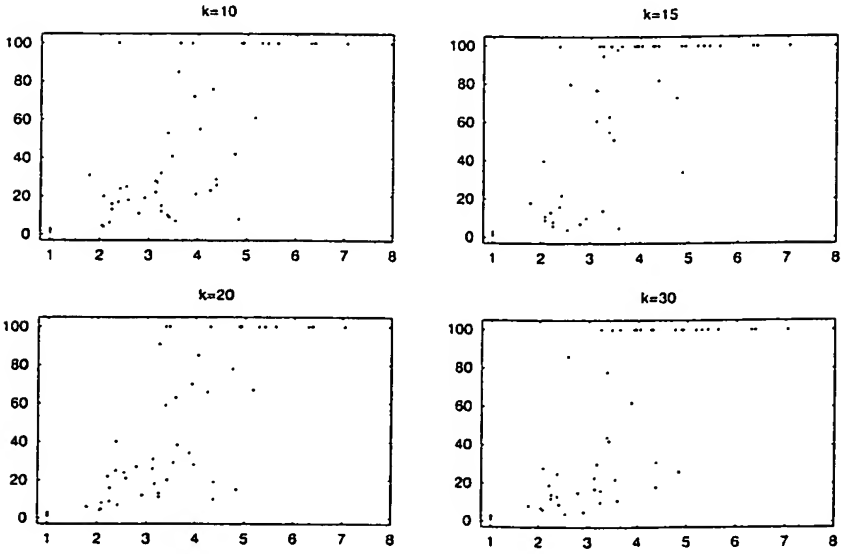
Fig. 15




*Distances of target windows against density ratio, Entree Chicago data*

Fig. 16




*Ranks of target windows against the density ratio, Entree Chicago data*